

REVIEW - QUADRATIC FUNCTIONS

KEY

BASIC CONCEPT QUESTIONS

1. Name and write the equation of the two forms we use to represent quadratic functions.

Standard Form: $y = ax^2 + bx + c$

Vertex Form: $y = a(x-h)^2 + k$

2. Circle all of the following functions that are quadratic functions.

$y = -\frac{1}{2}x + 3$

$y = 8x^2 - 7$

$y = x^2$

$y = 9x^3 - 5x^2 + 2$

$y = -6(x+1)^2$

3. Given an equation, how do you know if a parabola is concave up or concave down?

If a is positive \rightarrow concave up

a negative \rightarrow concave down

4. Given an equation, how do you know if the parabola will be skinnier or wider than the parent function?

$|a| > 1 \rightarrow$ skinnier

* negatives don't matter!

$|a| < 1 \rightarrow$ wider

Use absolute value!

5. What do c and k change about the graph?

Shift up + down (vertical translation)

6. What does the h value change about the graph?

Shift left and right (horizontal translation)

* opposite sign as what you see in $()$

7. What is the vertex?

Max or min value, turning point

8. How do you find the vertex of a quadratic function

a. From Standard Form?

b. From Vertex Form?

$x = -\frac{b}{2a}$ plug back in

(h, k)

9. From the equation, how can you tell if the vertex will be a maximum or a minimum?

$a > 0 \rightarrow$ Min

$a < 0 \rightarrow$ Max

10. What is the axis of symmetry?

11. How do you find the axis of symmetry?

a. From Standard Form?

b. From Vertex Form?

$x = -\frac{b}{2a}$

$x = h$

12. How do you find the y-intercept of any function?

plug in $x = 0$

13. List all the other names for "solutions" of a quadratic function.

roots, zeros, x-intercepts

14. What do you need to be sure is true about your function before you start finding solutions?

that it $= 0$

15. What are the 3 methods for finding solutions of a quadratic function?

① Graphing (find x-intercepts)

② Factoring + zero product property

③ Quadratic Formula

16. State the quadratic formula.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

17. What is the discriminant?

$$b^2 - 4ac$$

18. What does the value of the discriminant tell you about your function if it is

a. positive

b. negative

c. zero

2 real solutions

2 complex solutions

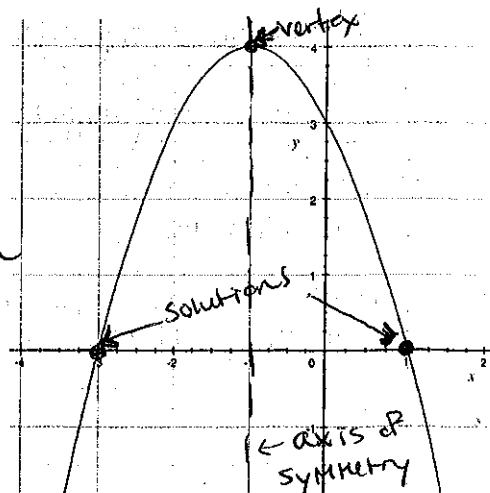
1 real solution

19. Label all of the key features (vertex, axis of symmetry, solutions, y-intercept) on the graph to the right.

20. Give either definition for i .

$$i = \sqrt{-1}$$

$$i^2 = -1$$



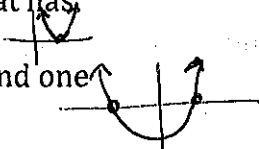
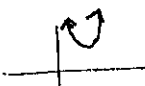
PRACTICE PROBLEMS

21. Consider the function $y = 4x^2 - 24x - 7$

- A. Find the y-intercept $(0, -7)$
 B. Will the vertex be a maximum or a minimum? Why? Min b/c a is positive
 C. Find the vertex. $x = \frac{24}{2(4)} = \frac{24}{8} = 3$ $4(3)^2 - 24(3) - 7 = -43$ $(3, -43)$

22. Sketch the graph of a quadratic function that has

- a. *exactly one* positive solution
 b. *exactly two* solutions, one positive and one negative
 c. *no real solutions*



$$x = \pm 5$$

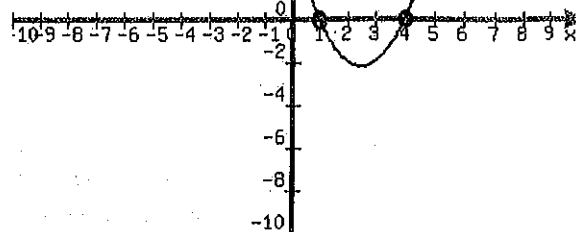
23. Find the solutions of $6x^2 = 150$

$$\sqrt{x^2} = \sqrt{25}$$

$$x = \pm 5$$

24. State the solution(s) of the quadratic function based on the graph to the right.

$$x = 1, 4$$



25. Find the solutions of $9x^2 = 4x$ by factoring. SHOW

ALL WORK. $9x^2 - 4x = 0$

$$x(9x - 4) = 0$$

$$x = 0$$

$$9x - 4 = 0$$

$$9x = 4$$

$$x = \frac{4}{9}$$

26. Find the solutions of $y = x^2 - 6x - 7$ by factoring. SHOW ALL WORK.

$$(x - 7)(x + 1) = 0$$

$$x - 7 = 0$$

$$x + 1 = 0$$

$$x = 7 \quad x = -1$$

27. Find the solutions of $y = -2x^2 + 6x + 5$ using the quadratic formula. SHOW WORK.

$$a = -2 \quad b = 6 \quad c = 5$$

$$b^2 - 4ac = 6^2 - 4(-2)(5) = 76$$

$$x = \frac{-6 \pm \sqrt{76}}{-4}$$

28. Find the solutions of $f(x) = 3x^2 + 2x + 7$ using the quadratic formula. SHOW WORK.

$$a = 3 \quad b = 2 \quad c = 7$$

$$b^2 - 4ac = 2^2 - 4(3)(7) = -80$$

$$x = \frac{-2 \pm \sqrt{-80}}{6} = \frac{-2 \pm i\sqrt{80}}{6}$$

29. Find the solutions of $x^2 + 7x = -10$ using the method of your choice. SHOW WORK.

$$x^2 + 7x + 10 = 0$$

$$+10 \quad +10$$

$$(x + 5)(x + 2) = 0$$

$$x + 5 = 0$$

$$x + 2 = 0$$

$$x = -5, -2$$

30. Find the solutions of $y = 5x^2 + 7x + 2$ using the method of your choice. SHOW ALL WORK.

$$y = (-1, 0)$$

$$Q.F.$$

$$b^2 - 4ac = 7^2 - 4(5)(2) = 9$$

$$x = \frac{-7 \pm \sqrt{9}}{2(5)} = \frac{-7 \pm 3}{10} \rightarrow \frac{-7+3}{10} = -\frac{4}{10} = -\frac{2}{5}$$

$$x = (-1, 0)$$

31. Write the equation of the quadratic function whose vertex is $(4, 5)$ through the point $(-2, 20)$.

$$20 = a(-2 - 4)^2 + 5$$

$$a = \frac{15}{36} = \frac{5}{12} \approx .417$$

$$y = \frac{5}{12}(x - 4)^2 + 5$$

32. Write the equation of the quadratic function whose solutions/roots are -4 and 5 .

$$x = -4$$

$$x + 4 = 0$$

$$(x + 4)(x - 5) =$$

$$x^2 - x - 20$$

33. Write the equation of a quadratic function that is concave up, skinnier than the parent function, and whose vertex is at $(2, 12)$

$$y = 3(x - 2)^2 + 12$$

34. Write the equation of a quadratic function that is concave down, wider than the parent function and is shifted down 5 units.

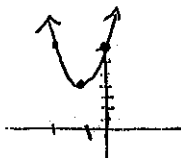
$$y = -\frac{1}{2}x^2 - 5$$

$$|a| < 1$$

35. Consider the function $f(x) = 2(x-5)^2 + 3$. Write the equation of a new function, $g(x)$, that takes $f(x)$ and shifts it 4 units left and 9 units down. $g(x) = 2(x-1)^2 - 6$

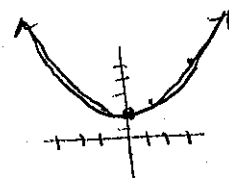
36. Graph the function $y = 3(x+1)^2 - 4$.

$(h, k) = (-1, -4)$



37. Graph the function $y = \frac{1}{3}x^2 + 2$.

$(0, 2)$



38. An object in the air is given by the equation $h(t) = -16t^2 + 4t + 8$.

a. Find the time when the object reaches its maximum height.

b. Find the maximum height of the object.

c. How high is the object after 3 seconds in the air?

d. When will the object hit the ground?

$t = \frac{-b}{2a} = \frac{-4}{2(-16)} = 0.125 \text{ sec}$

$h(3) = -124 \rightarrow \text{already landed!}$

8.25 ft

Solutions

39. If $f(x) = x^2$, find and simplify $f(3i) = (3i)^2 = 9i^2 = 9(-1) = -9$

40. Simplify $(3+7i) - (9+4i) = -6 + 3i$

41. Simplify $(3+7i)(9+4i) = 27 + 12i + 63i + 28i^2 = 27 + 48i - 28 = -1 + 48i$

42. Simplify $\sqrt{-36} = 6i$

43. Solve $x^2 = -81$. (Make sure you find BOTH solutions, not just one) $x = \pm 9i$

44. What is the value of x in the equation $\sqrt{x+4} = 2i$? $x+4 = (2i)^2 = 4i^2 = -4$

$x+4 = -4$

$x = -8$

45. What is the greatest common factor of $24a^3b^2c$ and $10ab^2c^3$? $2ab^2c$

46. If $5x$ is one factor of $10x^2 - 15x$, what is the other factor? $5x(2x-3)$

47. Factor $x^2 - 81$. $(x-9)(x+9)$

48. Factor $3x^2 - 12$ completely. $3(x^2 - 4) = 3(x-2)(x+2)$

49. What is a common factor of $x^2 + 3x - 10$ and $x^2 + 6x + 5$? $x+5$

$(x+5)(x-2)$

$(x+5)(x+1)$

50. Given the table, find the equation of the quadratic function.

$y = (x-3)^2$

x	y
1	4
2	1
3	0
4	1
5	4

vertex

$a=1$